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ABSTRACT

The construct validity of biographical items in the Individual Achievement Record (IAR) was assessed in an attempt to develop a confirmatory factor model. This first phase of a two-phase study focused on the IAR's use as a predictor of job performance. The IAR is an empirically keyed biodata inventory containing 112 multiple-choice items. Item content deals with educational background, work-related skills and abilities, and achievements in interpersonal endeavors. All items: deal with an event under the individual's control; have an apparent relevance to job performance; are verifiable; avoid invasion of the individual's privacy; and avoid stereotypes associated with race, sex, or national origin. An exploratory factor analysis was performed on 6,300 job incumbents. The analysis identified four factors: work competency, scholastic achievement, academic achievement, and leadership skills. Composites consisting of individual IAR items were used as observed indicators of the factors. Twelve composites, three per factor, were formed using 63 items. A specification search was conducted using four models to improve fit and meaning. The fit of one model was cross validated using a sample of 1,600 additional job incumbents. Results indicate that the derived model portrays the underlying content of the IAR model well. Phase II will compare factors and other measurement domains. A 54-item list of references, 7 tables, and 2 figures are included. (TJH)

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Construct Validity of the Individual Achievement Record: Phase I - Development of a Confirmatory Factor Model

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Construct Validity of the Individual Achievement Record: Phase I - Development of a Confirmatory Factor Model

Since the 1950s, biographical data ("biodata") have become increasingly recognized as effective and versatile tools in psychological assessment. Presently, in the field of employee selection, the popularity of biodata as a predictor of job performance stems largely from a record of demonstrably high validity and limited adverse impact (Hunter & Hunter, 1984; Reilly & Chao, 1980; Reilly & Warech, 1988).

Despite the continued success of biodata, researchers have been criticized repeatedly for their propensity to rely on empirical means to substantiate validity (Dunnette, 1962; Pace & Schoenfeldt, 1977). The typical approach of "blind empiricism" used in the development and validation of biodata inventories has impeded progress toward a conceptual understanding of biodata (Hough, 1986) and the very success of empirical techniques has been a liability in its own right (Mumford & Owens, 1987). Consequently, a major problem in biodata research is a lack of understanding about the nature of underlying constructs.

Determining the Underlying Nature of Biodata

One reason making it difficult to assess general constructs underlying biodata, and the role of biodata in predicting job performance, is that inventories differ greatly in content (Laurence and Means, 1985). While many inventories contain questions on educational background and previous work history, subject matter may include items dealing with family background, personal attitudes and beliefs, and socioeconomic status (Means & Perelman, 1984). Examples of the range of item content can be found in Glennon, Albright, and Owens (1961) and England (1971).

The effect of varying item content is that it likely means that biodata inventories differ in the underlying constructs that they measure. Unfortunately, there has been little research to develop taxonomies that compare systematically the relationships between the content of biodata items and underlying constructs.

Biodata in the Domain of Psychological Measures

One approach to improve the understanding of biodata as a predictor of job performance, but which has received little systematic attention, is to examine relationships to other types of psychological measures. Specific classes to which biodata have been compared include: a) measures of cognitive ability and aptitude, b) measures of achievement, and c) measures of general temperament or personality.

Correlational studies. Biodata have been regarded as complementary and efficient additions to batteries containing ability measures because of research demonstrating that there is a low correlation with cognitive ability (Baehr & Williams, 1967;

Levine & Zachert, 1951; Mosél, 1952a). Others report substantial correlations with tests of cognitive ability (Schmidt, 1987) and measures of academic achievement (Owens, 1976) implying that there are conceptual similarities between biodata and these types of measures.

Some studies report positive correlations between biodata and scores from inventories of temperament and personality (Hough, Dunnette, Wing, Houston, & Peterson, 1984; Mosél, 1952). Results such as these have prompted researchers to suggest that there is much in common between biodata and self-report measures of personality (Mumford & Owens, 1987; Rawls & Rawls, 1968) and support those who have long contended that measures of life history (biodata) are one of the most accurate means for revealing the personality (Dailey, 1960; Guthrie, 1944). Other researchers have pointed out conceptual differences between biodata inventories and personality tests. Biodata, which asks for the respondent to focus on past experiences in specified settings, can be distinguished from personality tests, which ask for responses in the form of general tendencies (Mumford & Owens, 1987).

Factor analyses. Factor-analytic studies of biodata can best be described as exploratory. Researchers have been mainly interested in using factor analysis as a data reduction tool and have made limited use of its power to improve conceptual understanding for biodata. Recently, there have been efforts to derive a list of generic biodata factors (Mumford & Owens, 1987) from a review of factor-analytic research. However, the procedures used in synthesizing the results from individual studies have been largely subjective in nature.

Some biodata factors have been shown to relate to scores from other types of measures. Academic achievement factors have been shown to be significantly related to high school GPA and Scholastic Aptitude Test scores (Owens, 1976; Owens & Schoenfeldt, 1979). Steinhaus (1988) and McDaniel (1988) found positive relationships between a school achievement factor and scores on the AFQT, a cognitive ability test. Some factors, such as extroversion, independence, maturity, and adjustment appear to be related to constructs identified in the personality literature (Tupes & Christal, 1961). One study has shown overlap between biodata factors and scales from interest and personality inventories (Hough et al. (1984).

One biodata factor of particular relevance is often referred to as self-esteem. Frequently, biodata inventories contain several items which ask respondents to provide self-assessments of various skills and abilities. These items usually load on the first emerging factor (Owens, 1976). An example is a study by Smith, et al. (1961) who claim that a self-confidence factor was derived from the "factual" nature of biodata items such as,

taking advantage of opportunities, performance in comparison to peers, speed in completing work assignments, and working on several things simultaneously. While some research has found similarity between a self-esteem biodata factor and scales from personality inventories related to self-confidence (Hough, et al, 1984), the nature of self-esteem in biodata is not well-researched.

Purpose of Present Research

It is clear that biodata share relationships with other measurement domains. This raises an obvious, but important point about the nature of biodata. Biodata does not represent an independent domain of individual difference variables, rather it is a measurement method in which individual inventories can be developed to be similar or different to measures from other domains (Hough, 1989; Mitchell, 1989). Thus, the underlying constructs measured by biodata and their relationships to other measurement domains likely depend on the content of the specific biodata inventory in question.

The objective of the present research is to determine the role of an empirically-keyed biodata instrument, the Individual Achievement Record (IAR), as a predictor of job performance (Gandy, Outerbridge, Sharf, & Dye, 1989). The purpose of this paper is to present preliminary findings pertaining to the development of a confirmatory factor model for the IAR. Steps for extending the factor model to other measurement domains during a subsequent phase of the research are discussed.

The implications of the present research are theoretical and practical. This study parallels the direction of research being taken to provide a conceptual basis for biodata. While it is anticipated that the findings will provide a greater understanding of biodata constructs and the role that biodata plays as a determinant of job performance, it is recognized that the IAR is necessarily different from other inventories since many content areas traditionally found in inventories were judged inappropriate in the existing merit system environment. On the practical side, the present research may suggest avenues for improving the efficiency of Federal government examining based on a greater understanding of the factors measured by the IAR and their interrelationships to other types of selection procedures.

Method

The present research is being conducted in two phases. In Phase I, a factor model for the IAR was developed and cross-validated. To reduce the amount of "brute empiricism" typically used to evaluate biodata instruments, methods of confirmatory factor analysis were used (Hayduk, 1987; Long, 1983). In the next phase (Phase II), the factors identified in Phase I will be clarified through systematic comparisons to instruments selected from well-known measurement domains.

The Individual Achievement Record

The IAR is an empirically-keyed biodata inventory containing 112 items. Item content deals with educational background, work-related skills and abilities, and achievements in interpersonal endeavors. Ideas for item content were adapted from sources such as England (1971) and Glennon, Albright, and Owens (1961). All of the items are multiple-choice format containing five response options, with most having an "escape" option. Nearly 90% of the items contain responses representing a logical continuum (Mumford & Owens, 1987).

To control for concerns about the appropriateness of item content in a merit system context, five decision rules were used in item development: 1) it must deal with an event under the control of the individual, 2) it must have an apparent relevance to job performance, 3) it must be verifiable (in principle), 4) it must be unlikely that an individual would perceive it to be an invasion of personal privacy, and 5) it avoids stereotyping by sex, race, or national origin. Table 1 provides examples of item content.

An exploratory factor analysis performed on a sample of 6,300 job incumbents identified four factors -- 1) work competency, 2) scholastic achievement (high school), 3) academic achievement (college/university), and 4) leadership skills (Dye, 1989). Table 2 provides a description of the factors and their intercorrelations. The factor descriptions suggest that the IAR contains two general components or "themes" -- a) achievements and accomplishments in academic settings (Factor 2 and Factor 3), and b) self-assessments of various skills, abilities, and accomplishments within work and social settings (Factor 1 and Factor 4). The factor intercorrelations lend support to these themes since the two highest correlations are between the two academic factors and the two self-assessment factors. It should be noted, however, that the work competency factor does correlate moderately with the two academic factors as well.

Description of Analysis

Phase I: Model Development

This phase was conducted to develop a confirmatory factor model for the IAR. The goal was to derive an acceptable model (in terms of statistical fit) that describes the content of the IAR in substantive terms. The original sample of job incumbents from the exploratory factor analysis was used to develop the model. A cross validation sample was used to confirm the model.

Initial model specification. Based on the factors identified in the exploratory analysis (see Table 2), an initial model containing four common factors was specified -- work competency, scholastic achievement (high school), academic achievement (college/university), and leadership skills. Research has shown that searches for proper factor models are more likely to be successful when initial models are carefully formulated (MacCallum, 1986).

Composites consisting of individual IAR items were used as observed indicators of the factors. For each of the four factors, items with loadings of .30 or higher were considered. Composites were formed by examining the content of items and rationally combining those representing similar experiences and behaviors. To simplify the structure of the initial model, items were assigned to one composite only. In the event that an item loaded on more than one factor, it was assigned to the composite of the highest-loading factor.

Twelve item composites, three per factor, were formed using a total of 63 items. Descriptions of the composites are in Table 3. A composite score was not computed for an individual if more than one item response was missing; in the event of a single missing item response, a mean value based on the entire sample was imputed. Coefficient alphas were computed to estimate the reliability of the composites. These are shown in Table 3.

Each item composite was specified to load on a single factor only. Correlations among the four common factors were left free to be estimated. No correlations were postulated among the error associated with the unique variance of the observed item composites. Scales for the factors were set by fixing the variances to 1.0 (Anderson & Gerbing, 1988). An illustration of the initial model is in Figure 1.

A correlation matrix of the item composites using pairwise deletion of cases was computed and used as input. Fit of the model was examined with PC-LISREL Version VI (Jöreskog & Sörbom, 1986). A sample size of 4,821 was used, representing the smallest number of cases for a pairwise correlation among the 12 composites.

Model respecification and assessment of fit. A specification search was conducted using procedures recommended by MacCallum (1986). A specification search is a sequential process of modifying a factor model to improve its fit and meaning. Ways to improve model fit include 1) adjusting the proposed number of factors, 2) altering the assignment of observed indicators to the factors, and 3) modifying the relationships among correlational terms in the model.

For each step in the search, estimated parameters and their respective t-values were examined. Modification indices (MI) and the patterns of residual terms were examined to identify possible errors in specification. Because a single change in the specification of a model can influence the other parameters in a model, modifications were made one at a time (Hayduk, 1987). Specification changes were made only if they were warranted on substantive or reasonable grounds (Hayduk, 1987; MacCallum, 1986).

Three sequential modifications were made during the specification search. In examining the fit of the initial model (Model 1), several large MIs and normalized residual terms were observed. The largest MI called for the "academic evaluations" composite on Factor 2 (scholastic achievement) to be set free on Factor 1 (work competency). The pattern of residuals called for the same modification since the three largest values were between the "academic evaluation" composite and the three composites loading on the work competency factor. Because it is reasonable to expect that one's perceptions of his/her academic skills and potential is related to perceived levels of competency required for the workplace, the loading for the "academic evaluations" composite was set free for Factor 1. This specification change resulted in Model 2.

A third model (Model 3) was specified by allowing the composite of "academic skills" on the work competency factor (Factor 1) to be set free on the scholastic achievement factor (Factor 2). As with Model 2, this modification was warranted by a large MI on Factor 2 and by the pattern of residual terms. This modification was considered reasonable since one's perceptions of his/her skills in basic academic areas such as reading, math, and vocabulary is likely related to achievement in the high school setting.

The results for the third model still showed some large MIs and residual terms. The largest MIs and the pattern of residuals indicated that the observed correlation between the composites of "specific subject grades (high school)" and "specific course grades (college/university)" (.29) was greater than accounted for by the model. In other words, other factors responsible for the correlation between grades in high school and college were not

being fully explained by the four factors in the model. To improve the fit, a fourth model was specified by freeing the error parameter associated with the unaccounted for correlation between the two composites. It is recognized that the freeing of error terms does not necessarily provide any indication of what additional factors might be necessary to account for the correlation. However, it was decided to evaluate the merit of freeing the parameter by examining the subsequent effect on the factor loadings and considering the relative improvement in fit (Bagozzi, 1973; Fornell, 1973).

The results of the fourth model still showed that improvements in fit could be made by allowing the high school and college achievement factors to be more closely related. Specifically, the MIs and pattern of residuals called for allowing two of the college achievement composites to load on the high school achievement factor. However, the freeing of similar high school achievement composites on the college achievement factor was not called for. Because of this conceptual inconsistency, the specification search was stopped.

Results

All four of the models examined in the specification search contained significant factor loadings for the freed parameters. Thus, judgments about model fit need to consider absolute measures and relative comparisons of overall fit. Table 4 provides such information.

Referring to the top half of Table 4, stand-alone indices, which assess overall model fit in absolute terms, are given. The model numbers refer to the sequential order in the specification search. To assist in determining the improved fit of the models in the search, the fit of a "null" model is also examined. When properly framed, a null model provides a baseline to which the fit of each of the "target" models in the specification search can be compared (Anderson & Gerbing, 1988; Bentler & Bonett, 1980). In this case, the null model was specified to have 12 independent factors (i.e., no common factors) and uncorrelated residual terms.

The chi-square statistic is a traditional measure of overall fit in which nonsignificant values indicate acceptance of a model. According to the top half of Table 4, all of the models are rejected at a high significance level ($p<.001$). However, because it is well known that the chi-square statistic is inflated by large sample sizes (i.e., >500), its absolute value is not considered in evaluating the fit of the four models. The goodness of fit index (GFI), which is less affected by sample size, provides a measure of the relative amount of variance and covariance jointly accounted for by the model (Jöreskog & Sörbom,

1986). All of the GFIs are above .94. As expected, increases in GFI are seen when moving from Model 1 to Model 4 indicating sequential improvements in fit. The RMSR value, which is a measure of the average magnitude of the residuals, ranges from .062 to .022. As expected, sequential improvements in fit are shown moving from Model 1 to Model 4.

There are very few guidelines offered as to what values of GFI and RMSR constitute "acceptable fit". In a Monte Carlo study, Anderson and Gerbing (1984) found mean values for GFI and RMSR for a model of four factors and three indicators per factor were .923 and .054, respectively. Under these guidelines, all of the target models in Table 4 can be considered acceptable.

To assist in identifying a preferred model, the lower half of Table 4 provides statistics of incremental improvements in fit. These statistics, which are useful in comparing "nested" models, can assist in judging when a specification search is successful. Referring to Table 4, comparisons can be made between the fit of each of the four target models against the null model.

The chi-square statistic provides a significance test of the difference in fit between the null and target models. Again, because of the large sample size its absolute value is not meaningful. The TL-BB index provides a comparison between the fit of a target model against the null model and is similar to a reliability index (Tucker & Lewis, 1973; Bentler & Bonnet, 1980). Models with TL-BB values below .90 are generally considered unacceptable (Bentler & Bonnet, 1980; Marsh, Balla, & McDonald, 1988). The delta index (δ) expresses the improvement in fit for target models as a proportion of the chi-square of the null model. When subtracted from 1.0, it gives a percentage of improvement in fit that can be expected with further model modifications.

As expected, sequential improvements in fit are achieved as additional parameters are freed when moving from Model 1 to Model 4. Based on the TL-BB values and the interpretability of the models, it is reasonable to consider Model 3 as the preferred choice. Recall that Model 3 allowed for the two composites of "academic evaluations" and "academic skills" to double load on the work competency and scholastic achievement factors. These allowances make conceptual sense and provide a practical improvement in fit over Models 1 and 2. The δ index indicates that further modifications to improve the fit of Model 3 would only realize a gain of 3.5%. Although Model 4 does represent a better fit than Model 3, the statistical gains made by freeing the associated error term are achieved with no improvement in interpretability of the two achievement factors. Also, the correlation for the freed error term in Model 4 was estimated to be only .11, suggesting that the unaccounted for correlation is

small. Figure 2 provides an illustration of Model 3 representing the double loadings for the two item composites.

Confirmation of Model

Because a specification search has the potential for capitalizing on chance factors in the data, the fit of Model 3 was cross validated on a new sample. Cross validation is highly recommended to confirm the stability of developed factor models (Cudeck & Browne, 1983; MacCallum, 1986; Bentler & Chou, 1987).

Using data collected on an additional sample of 1,600 job incumbents, model fit was examined. In terms of overall fit, the computed GFI and RMSR values in the cross validation sample were found to be identical to the original sample, .923 and .054, indicating that the fit of the model holds in an independent sample.

A more accurate assessment of the soundness of the model 3 can be made by a comparison of the estimated factor loadings and intercorrelations between the original and cross validation samples. Referring to Table 5, the values are very similar. Differences in corresponding factor loadings between the two samples range from .01 to .05. The largest difference in corresponding factor intercorrelations is between Factor 2 and Factor 4 (.14). All others are .06 or less. From these comparisons, it can be concluded that the model is stable.

Discussion

The results of Phase 1 indicate that the derived model portrays the underlying content of the IAR well. The identified factors are generally consistent with the belief that the IAR measures an individual's record of achievements and accomplishments in academic, work, and social settings (Gandy, et al., 1989). Based on the results of the cross validation analysis, great faith can be placed in the stability of the model.

It is worth noting that the model derived from the specification search closely resembles the initial model, both conceptually and statistically. The only structural differences between them was an allowance for two "academically-oriented" achievement composites to double load on the work competency and high school achievement factors. In practical terms, these changes did not significantly alter the content of the factors and the factor descriptions provided in Table 2 can be considered accurate. The values of the estimated factor loadings and intecorrelations were also extremely similar between the initial and final model. This suggests that the exploratory analysis provided a good starting model.

Of greatest importance is a discussion of the underlying meaning of the model. In structural terms, the model is not complex. The four factors identified do a very reasonable job of accounting for the relationships among the items in the IAR. Ten of the twelve item composites load on a single factor only.

When considering the content of the individual factors, however, the meaning is more complex. Conceptually speaking, the factors represent past achievements and accomplishments, and behavioral self-assessments. It should be obvious that they do not represent pure, unidimensional traits or constructs; they are content-based. It is reasonable to assume, however, that past achievements are manifestations of more enduring personal qualities and behavioral tendencies. For example, it is likely that high achievement in academic settings is related to a desire to succeed and a willingness to work hard. It is also reasonable to assume that academic achievement is indicative of level of intellectual ability.

A feature of the model worth noting is that each factor represents events or behaviors occurring within a specific setting or period in life, namely high school, college, work, and interpersonal. It is not clear if these different settings are conceptually meaningful, but it raises several questions. Do separate factors for high school and college suggest that the skills that are acquired and the levels of achievement that are exhibited different in some respects? Are any of the personal qualities indicative of success in academic settings the same as

those in the workplace? Do the skills needed for effective leadership differ from more general work skills in some way? On the other hand, the factors were found to be correlated suggesting that they share some similarities.

Another distinguishing feature of the model already mentioned is the element of self-assessment. The items in the work competency and leadership skills factors require self-assessments to be made regarding several relevant skills, abilities, and behaviors. The items contained in the factors of high school and college achievement (except the "academic evaluations" composite) generally require much less introspection, and instead ask for reports that are more objective and potentially verifiable. The pattern of correlations among the factors in Table 5 illustrated this distinction. It is not clear if the degree of self-assessment is conceptually important. Again, several questions can be raised. Does self-assessment relate to one's level of self-esteem? Are the self-assessments of leadership skills and general work skills different? How do self-assessments and self-esteem relate to the presence of underlying personal qualities? Do the more objective academic achievement factors relate to different sets of skills and individual qualities? How does level of intellectual ability relate to each of the factors?

To answer these questions and to gain a better understanding of the conceptual meaning of the IAR, it is necessary to make systematic comparisons between the factors and other well-known measurement domains. This is the purpose of the second phase of the research.

Further Research

Phase II: Extension of Model to Other Domains

To examine relationships between the IAR and other areas, four relevant measurement domains have been identified -- a) cognitive ability and aptitude, b) temperament and personality, c) work values, and d) vocational interests.

Two sets of guidelines were followed to select individual measures within the four domains. The first set was used to select instruments that broadly cover one of the four domains. The second set was used to select individual subscales considered to be closely related to the identified IAR factors.

Under the first set of guidelines, four instruments were selected. Respectively, they are a cognitive ability test (Northrop, Nester, Diané, & Colberg, 1989), the NEO Personality Inventory (Costa & McCrae, 1985), the Comparative Emphasis Scale (Ravlin & Meglino, 1986), and the Self-Directed Search (Holland, 1985). All of these instruments were considered to meet the

following established criteria: 1) it is considered to cover the domain from which it is drawn, 2) it assesses constructs believed to be applicable to the work setting and important for predicting job performance for a wide cross-section of jobs, 3) the individual scales have relatively high levels of internal consistency, and 4) the item content is considered appropriate for normal adult populations.

Under the second set of guidelines, eight scales were selected, four related to self-esteem and four representing aspects of achievement. The self-esteem scales chosen were the Revised Janis-Field Self-esteem scale (Robinson & Shraver, 1973) and three scales from the California Psychological Inventory (Gough, 1987) -- Capacity for Status, Self-acceptance, and Social Presence. The Janis-Field scale and the CPI Self-acceptance scale are believed to be measures of general self-esteem (Gough, 1987; Robinson & Shraver, 1973) whereas the Capacity for Status and Social Presence scales are related to self-esteem with an emphasis in social settings. The achievement scales chosen include three from the CPI -- Achievement via Conformance, Achievement via Independence, Work Orientation (Gough, 1987) as well as Rotter's Locus of Control scale (Rotter, 1966). CPI Achievement via Conformance has been shown to be related to achievement in relatively structured settings such as high school (Gough, 1964); Achievement via Independence is related to performance in less structured settings such as college (Gough & Lanning, 1986). CPI Work Orientation is believed related to a strong work ethic (Gough, 1985). Rotter's Locus of Control scale has demonstrated relatively good empirical validity for predicting job performance (Hough, et al., 1986). A list of all of the instruments and the various scales is provided in Table 6.

Hypotheses

It is hypothesized that the IAR factors of academic achievement (factors 2 and 3) will have the greatest relationships with scores denoting aptitude or achievement in other domains. It is anticipated that the IAR factors of work competency and leadership skills (factors 1 and 4) are expected to show the greatest relationships with the scales denoting self-assessment and social behaviors. The proposed initial assignment of the measures to the IAR factors is in Table 7.

Prediction of job performance. To derive general conclusions about the role of the IAR as a predictor of job performance, stepwise multiple regression analyses will be performed. Predictors will consist of total scores for the IAR and the other measures. The criterion of job performance will be a unit-weighted summation of supervisory appraisal scales.

It is hypothesized that improvements to prediction of job performance will be realized from composite scores consisting of

the IAR and the other measures. While it is believed that the IAR will be at most moderately related with the other domains, the degree to the other measures provide any incremental validity will depend on their relationship to the job performance criterion.

References

Anderson, J. C., & Gerbing, D. W. (1984). The effect of sampling error on convergence, improper solutions, and goodness-of-fit indices for maximum likelihood confirmatory factor analysis, Psychometrika, 49, 155-173.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. Psychological Bulletin, 103, 411-423.

Baehr, M. E., & Williams, G. B. (1967). Underlying dimensions of personal background data and their relationship to occupational classification. Journal of Applied Psychology, 51, 481-490.

Bagozzi, R. P. (1983). Issues in the application of covariance structure analysis: A further comment. Journal of Consumer Research, 9, 449-450.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin, 88, 588-606.

Bentler, P. M., & Chou, C. (1987). Practical issues in structural modeling. Sociological Methods & Research, 16, 78-117.

Costa, P. T., & McCrae, R. R. (1985). The NEO Personality Inventory Manual. Odessa, FL: Psychological Assessment Resources, Inc.

Cudeck, R., & Browne, M. W. (1983). Cross-validation of covariance structures. Multivariate Behavioral Research, 18, 147-167.

Dailey, C. A. (1960). The life history as a criterion of assessment. Journal of Counseling Psychology. 7, 20-23.

Dunnette, M. D. (1962). Personnel Management. In P. R. Farnsworth, O. McNemar, & Q. McNemar (Eds.), Annual Review of Psychology (pp. 285-314). Palo Alto: Annual Reviews, Inc.

Dye, D. A. (1989). A proposal to evaluate the underlying characteristics of the Individual Achievement Record. Washington, DC: U.S. Office of Personnel Management.

England, G. W. (1971). Development and use of weighted application blanks (Rev. ed., No. 55). Minneapolis, MN: University of Minnesota, Industrial Relations Center.

Fornell, C. (1983). Issues in the application of covariance

structure analysis: A comment. Journal of Consumer Research, 9, 443-448.

Gandy, J. A., Outerbridge, A. N., Sharf, J. C., & Dye, D. A. (1989). Development and initial validation of the Individual Achievement Record (IAR). Washington, DC: U.S. Office of Personnel Management.

Glennon, J. R. , Albright, L. E., & Owens, (1961). A catalog of life history items. Washington, DC: Scientific Affairs Committee, American Psychological Association, Division 14.

Gough, H. G. (1964). Academic achievement in high school as predicted from the California Psychological Inventory. Educational and Psychological Measurement, 55, 174-180.

Gough, H. G. (1985). A work orientation scale for the California Psychological Inventory. Jcurnal of Applied Psychology, ,70, 505-513.

Gough, H. G. (1987). Manual for the California Psychological Inventory. Palo Alto: Consulting Psychologists Press.

Gough, H. G., & Lanning, Predicting grades in college from the California Psychological Inventory. Educational and Psychological Measurement, 46, 205-213.

Guthrie, E. R. (1944). Personality in terms of associative learning. In J. McV. Hunt (Ed.), Personality and the behavior disorders (Vol 1). New York: Ronald Press.

Hayduk, L. A. (1987). Structural equation modeling with LISREL: Essentials and advances. Baltimore: Johns Hopkins University Press.

Holland, J. L. (1985). The Self-Directed Search. Odessa, FL: Psychological Assessment Resources, Inc.

Hough, L. (Ed.). (1986). Literature review: Utility of temperament, biodata, and interest assessment for predicting job performance (Report No. 116). Minneapolis: Personnel Research Decisions Institute.

Hough, L. M. (1988, August). Development of personality measures to supplement selection decisions. Paper presented at the 24th Annual International Congress of Psychology Convention, Sydney, Australia.

Hough, L. M. (1989, April). Biodata and the measurement of individual differences. In T. R. Mitchell (Chair), Biodata vs. personality: The same or different classes of individual

differences. Symposium conducted at the fourth annual meeting of the Society for Industrial and Organizational Psychology, Boston, MA.

Hough, L., Dunnette, M. D., Wing, H., Houston, J. S., & Peterson, N. G. (1984). Covariance analyses of cognitive and noncognitive measures of Army recruits: An initial sample of preliminary battery data. In N. K. Eaton, M. H. Goer, J. H. Harris, & L. M. Zook (Eds.), Improving the selection, classification and utilization of Army enlisted personnel: Annual report 1984 fiscal year (Technical Rep. 660). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.

Hunter, J. E., & Hunter, R. F. (1984). Validity and utility of alternative predictors of job performance. Psychological Bulletin, 96, 72-98.

Jöreskog, K. G., & Sörbom, D. (1986). LISREL VI User's Guide (4th ed.). Mooresville, IN: Scientific Software, Inc.

Laurence, J. H. , & Means, B. (1985). A description and comparison of biographical inventories for military selection. (Report 85-5). Alexandria, VA: Human Resources Research Organization.

Levine, A. S., & Zachert, V. (1951). Use of biographical inventory in the Air Force classification program. Journal of Applied Psychology, 35, 241-244.

Long, J. S. (1983). Confirmatory factor analysis: A preface to LISREL. Beverly Hills: Sage Publications.

MacCallum, R. (1986). Specification searches in covariance structure modeling. Psychological Bulletin, 100, 107-120.

McDaniel, M. A. (1988, August). Biographical constructs for predicting employee suitability. Paper presented at the annual meeting of the American Psychological Association, New York, NY.

Means, B., & Perelman, L. S. (1984). The development of the educational and biographical information survey (Report 84-3). Alexandria, VA: Human Resources Research Organization.

Mitchell, T. R. (1989, April). Do biodata measure personality: Different, better, and/or more? In T. R. Mitchell (Chair), Biodata vs. personality: The same or different classes of individual differences. Symposium conducted at the fourth annual meeting of the Society for Industrial and Organizational Psychology, Boston, MA.

Mosél, J. N. (1952a). Prediction of department store sales performance from personal data. Journal of Applied Psychology, 36, 8-10.

Mosél, J. N. (1952b). The validity of rational ratings on experience and training. Personnel Psychology, 5, 1-10.

Mumford, M. D. (1983). Life history dimensions and types between age 18 and 30. Unpublished doctoral dissertation, University of Georgia, Athens, GA.

Mumford, M. D., & Owens, W. A. (1987). Methodology Review: Principles, procedures, and findings in the application of background data measures. Applied Psychological Measurement, 11, 1-31.

Northrop, L. C., Nester, M. A., Diané, C. & Colberg, M. (1989). Development of tests for job families. Washington, DC: Office of Personnel Management.

Owens, W. A. (1976). Background data. In M. D. Dunnette (Ed.), Handbook of industrial and organizational psychology (pp. 609-644). Chicago: Rand McNally.

Owens, W. A., & Schoenfeldt, L. F. (1979). Toward a classification of persons. Journal of Applied Psychology, 64, 569-607.

Pace, L. A., & Schoenfeldt, L. F. (1977). Legal concerns in the use of weighted applications. Personnel Psychology, 30, 159-166.

Ravlin, E. C., & Meglino, B. M. (1986). Comparative Emphasis Scale. Columbia, SC: University of South Carolina, Riegel and Emory Center.

Rawls, D., & Rawls, J. R. (1968). Personality characteristics and personal history data of successful and less successful executives. Psychological Reports, 23, 1032-1034.

Reilly, R. R., & Chao, G. T. (1982). Validity and fairness of some alternative employee selection procedures. Personnel Psychology, 35, 1-62.

Reilly, R. R., & Warech. M. A. (1988, August). The validity and fairness of alternative predictors of occupational performance. Unpublished manuscript.

Robinson, J. R., & Shraver, P. R. (1973). Measures of social psychological attitudes. Ann Arbor, MI: Institute for Social Research.

Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs, 80, (1 Whole No. 609).

Smith, W. J., Albright, L. E., Glennon, J. R., & Owens, W. A. (1961). The prediction of research competence and creativity from personal history. Journal of Applied Psychology, 45, 59-62.

Steinhaus, S. (1988). Predicting military attrition from educational and biographical information (Report 88-06). Alexandria, VA: Human Resources Research Organization.

Tucker, L. R., & Lewis, C. (1973). A reliability coefficients for maximum likelihood factor analysis. Psychometrika, 38, 1-10.

Tupes, E. C., & Christal, R. E. (1961). Recurrent personality factors based on trait ratings (USAF ASD Technical Report No. 61-97). Lackland Air Force Base, TX: U.S. Air Force.

U.S. Office of Personnel Management (1972). Federal Personnel Manual. 337-1.

Table 1
Sample items - Individual Achievement Record

1. My high school teachers would most likely describe my self discipline as:

   A. superior
   B. above average
   C. average
   D. below average
   E. don't know

2. The number of high school clubs and organized activities (such as band, sports, newspaper, etc.) in which I participated was:

   A. 4 or more
   B. 3
   C. 2
   D. 1
   E. didn't participate

3. My grade point average in my college major was:

   A. I did not go to college or went less than two years
   B. less than 2.90
   C. 2.90 - 3.19
   D. 3.20 - 3.49
   E. 3.50 or higher

4. In the past three years, the number of different paying jobs I have held for more than two weeks is :

   A. 7 or more
   B. 5 - 6
   C. 3 - 4
   D. 1 - 2
   E. none

5. My previous supervisors (or teachers if not previously employed) would most likely describe my problem solving skills as:

   A. superior
   B. above average
   C. average
   D. below average
   E. don't know

Table 2
IAR Factor Descriptions

1. Work Competency

Pertains to self-assessed levels of skills and abilities applicable to the work (or school) setting from the perspective of previous supervisors (or teachers). Deals with perceptions of: a) general and specific job-related skills, abilities, and job performance (e.g., problem solving, logical reasoning), b) work habits (e.g., meeting deadlines, attention to detail), and c) skills in basic achievement areas (e.g., math, vocabulary, reading).

2. Scholastic achievement (high school)

Refers to achievement in high school as occurring within the classroom. Deals mostly with self reports of grades received, class standing, and academic honors. To a slightly lesser degree, deals with self-perceptions of academic potential and discipline as viewed by teachers.

3. Academic achievement (college/university)

Refers to academic performance in the classroom at the college level. Deals with reported grades received, class standing, and number of honors obtained. Does not refer directly to either the amount or types of college coursework taken.

4. Leadership Skills

Pertains to self-assessed levels of leadership qualities (e.g., confidence, influencing others, aggressiveness) from the perspective of peers; to a lesser extent, deals with actual roles played in group situations both at work and in social settings; and perceptions of job-related skills that represent leadership roles (e.g., quick thinking, doing several tasks simultaneously, supervisor potential).

IAR Factor Intercorrelations

	Factor			
	1	2	3	4
1. Work Competency	--	24	25	48
2. Scholastic Achievement		--	35	12
3. Academic Achievement			--	05
4. Leadership Skills				--

Table 3
IAR Item Composites

Factor 1: Work Competency

Academic skills - skills in basic academic areas (e.g., math, vocabulary, reading, writing). Alpha= .80

Work skills and abilities - general job-related skills and abilities (e.g., problem solving, logical reasoning, analytical); reported levels of previous performance ratings and performance/advancement relative to peers. Alpha = .88

Work habits - specific work-related habits and skills (e.g., meeting deadlines, speed of work, attention to detail, etc.). Alpha = .83

Factor 2: Scholastic achievement (High school)

Overall academic standing - composite grades received, # courses failed, frequency of academic honors. Alpha = .82

Specific subject grades - grades received in various subject matter (e.g., English, math, science). Alpha = .68

Academic evaluations - perceptions of teachers' descriptions of academic work, potential, and self discipline. Alpha = .74

Factor 3: Academic achievement (college/university)

Overall academic standing - composite grades received, academic performance (e.g, all 4-years, in major, last two years, etc.), class standing. Alpha = .91

Specific course grades - grades received in various subject matter areas (i.e., English, math, science). Alpha = .53

Honors, awards - frequency of honors and awards (i.e., Dean's list, honor societies). Alpha = .63

Factor 4: Leadership Skills

Leadership qualities - perceived levels of qualities associated with leadership (e.g., confidence, risk-taking, aggressiveness, advice-giving). Alpha = .72

Persuasiveness skills - skill/behavior in expressing your views; influencing other's viewpoint. Alpha = .57

Leader roles - frequency of roles played denoting leadership. Alpha = .57

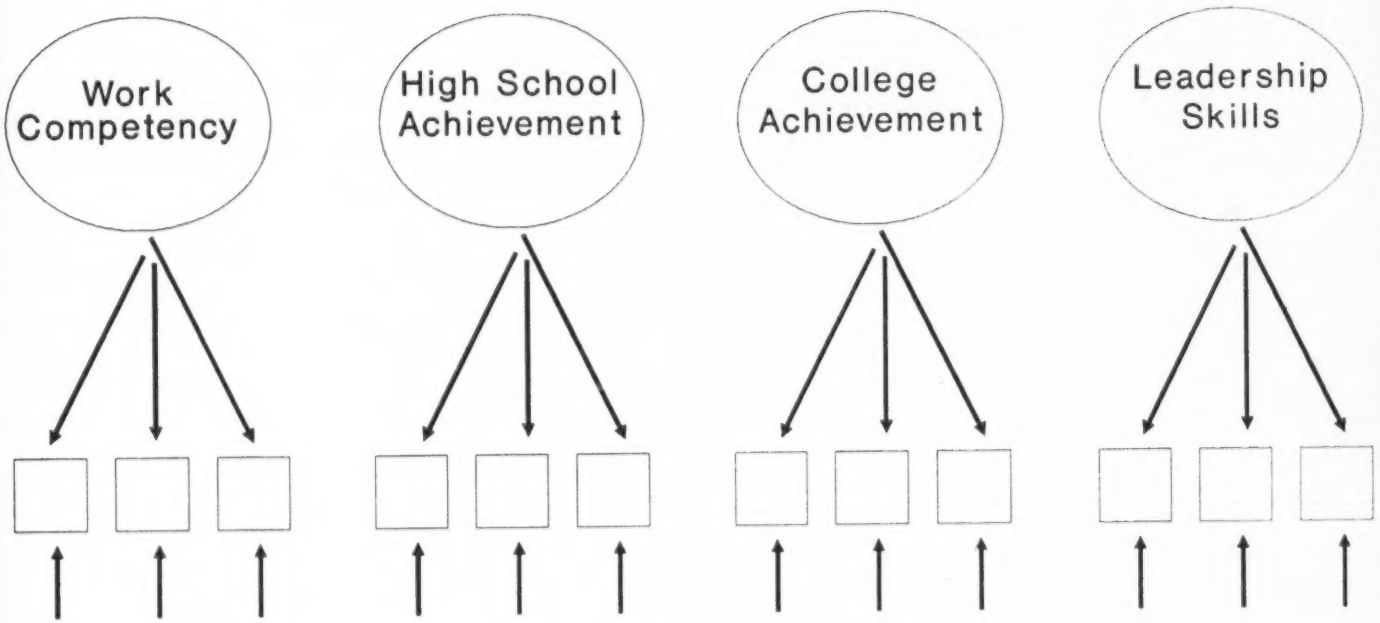

Figure 1. IAR Model: Initial Specification

Table 4
Assessment of Model Fit

Stand-alone indices

Model	df	X^2	GFI	RMSR
Null	66	28,692.09*	.439	.314
Model 1	48	1,799.10*	.943	.062
Model 2	47	1,364.00*	.955	.050
Model 3	46	972.47*	.969	.032
Model 4	45	620.50*	.985	.022

Incremental indices

Comparison	df	X^2	TL-BB	δ
Null vs Model 1	18	26,892.99*	.916	.937
Null vs Model 2	19	27,328.09*	.935	.952
Null vs Model 3	20	27,719.62*	.954	.966
Null vs Model 4	21	28,071.59*	.971	.978

*$p<.001$

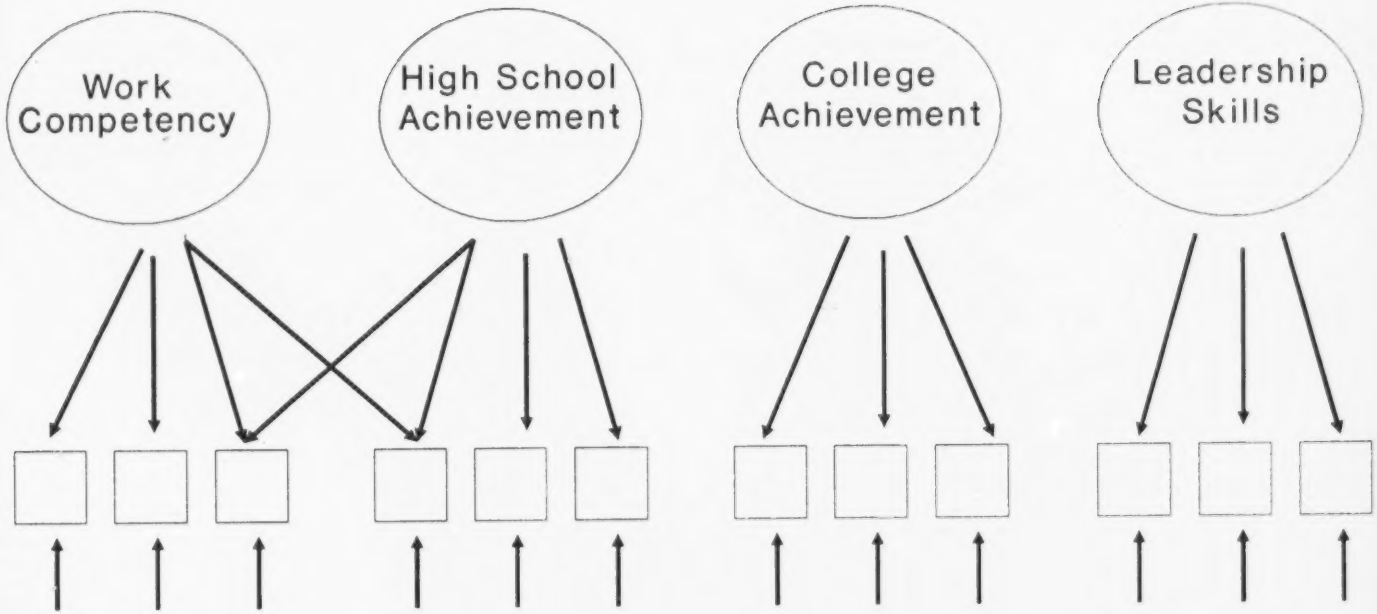

Figure 2. IAR Model: Specification Search

Table 5
Cross-validation of model

Item Composite	Work Competency	High School Achievement	College Achievement	Leadership Skills
	--- Factor loadings ---			
1	.62 (.59)	.23 (.22)		
2	.96 (.98)			
3	.79 (.76)			
4			.89 (.94)	
5			.79 (.81)	
6			.75 (.78)	
7		.90 (.86)		
8		.88 (.87)		
9	.22 (.20)	.72 (.69)		
10				.80 (.83)
11				.73 (.76)
12				.39 (.34)

Factor intercorrelations

Factor	Work Competency	High School Achievement	College Achievement	Leadership Skills
Work Competency	------			
High School Achievement	.20 (.26)	------		
College Achievement	.24 (.23)	.44 (.49)	_____	
Leadership Skills	.63 (.63)	-.02 (.12)	.09 (.08)	_____

Table 6
Instruments within Measurement Domains

Cognitive Ability/Aptitude

- OPM-developed Cognitive Ability Test
  - Verbal reasoning
  - Verbal comprehension
  - Mathematical reasoning

Temperament/Personality

- NEO Personality Inventory
  - Neuroticism
  - Extraversion
  - Openness
  - Agreeableness
  - Conscientiousness
- Rotter's Locus of Control Scale
- California Psychological Inventory Scales
  - Capacity for Status
  - Self-acceptance
  - Social Presence
  - Achievement via Conformance
  - Achievement via Independence
  - Work Orientation
- Janis-Field Self-esteem Scale

Work Values

- Comparative Emphasis Scale
  - Achievement
  - Concern for others/helping
  - Honesty
  - Fairness

Vocational Interests

- Self-Directed Search
  - Realistic
  - Investigative
  - Artistic
  - Social
  - Enterprising
  - Conventional

Table 7
Initial Assignment of Markers to IAR Factors

Factor 1: Work Competency

Janis-Field self-esteem
Self-acceptance (CPI)
Work Orientation (CPI)

Factor 2: Scholastic achievement (high school)

Achievement via Conformance (CPI)
Work Orientation (CPI)
Cognitive Ability scales
NEO - Conscientiousness
CES - Achievement

Factor 3: Academic achievement (college/university)

Achievement via Independence (CPI)
Work Orientation (CPI)
Cognitive Ability scales
NEO - Conscientiousness
CES - Achievement

Factor 4: Leadership Skills

Capacity for Status (CPI)
Social Presence (CPI)